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09/808,016	03/15/2001	Kazuo Maeda		4596

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EXAMINER
KILDAY, LISA A

ART UNIT	PAPER NUMBER
2829	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/808,016	Applicant(s) MAEDA ET AL.	
	Examiner Lisa A Kilday	Art Unit 2829	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 May 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *8-10,12 and 16-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *8-10,12 and 16-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 September 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *13* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Specification

The disclosure is objected to because of the following informalities: NO2, NO3, should be changed to "NO_2^-, NO_3^-.

Appropriate correction is required.

The disclosure is objected to because of the following informalities: chemical formulas, should be written as: "Silicon nitride" not –silicon nitride--. When an element occurs alone such as "Oxygen", it should be capitalized. If it is the second ion in a chemical compound, it does not have to be capitalized. Capitalize all elements.

Appropriate correction is required.

Claims 9, 16-25 are objected to because of the following informalities: chemical formulas, should be written as: "Silicon nitride" not –silicon nitride--. When an element occurs alone such as "Oxygen", it should be capitalized. If it is the second ion in a chemical compound, it does not have to be capitalized. Capitalize all elements.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 16-20, 25 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the

invention. Applicant is not granted a benefit of priority for the term "and their derivatives" under 35 U.S.C. 120 until applicant demonstrates disclosure of a reasonable "representative number of species" to support today's broad genus encompassing the concept of an etchant is an amide having a chemical formula NRnH3-n (n=1, 2, 3, R: alkyl group). See Guidelines for Examination of Patent Applications under 35 U.S.C. 112, 66 Fed. Reg. 1099 (2001). If applicant desires the benefit of priority under 35 U.S.C. 120, applicant must specifically point out where a representative number of species supporting the genus of claims 16-20, 25 appears *in the specification*.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> **The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.**

Claim 23 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "predetermined" in claim 23 is a relative term, which renders the claim indefinite. The term "predetermined" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The use of "predetermined" in claim 23 reads on a nebulous mental step conducted prior to the manipulative steps of the claimed process, hence rendering the present process claim unclear in meaning in scope. If applicant wishes to patent detail controls over the recited process, then the process steps must be positively recited. See Seagram &

Sons Inc. vs. Marshall, 84 USPQ 180. Removal of the world "predetermined" would overcome this rejection.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 8-10, 16-18, 23, 25 are rejected under 35 U.S.C. 102(b) as being anticipated by Hitachi (UK 1,342,637). Hitachi discloses in figures 1, 12-16 a semiconductor device manufacturing method comprising the steps of: contacting a surface of Silicon oxide film with an aqueous solution containing any one of NO2- and NO3- and forming an insulating film by CVD on the surface after the film-forming surface is contacted with the aqueous solution (pg. 3, lines 108-122; pg. 5, lines 74-87; pg. 7, lines 5-26).

In re claim 9, Hitachi discloses a mixed solution containing NH3, H2O2 as the aqueous solution (pg. 7, lines 14-20).

In re claim 10, Hitachi discloses wherein NO3 is added to the aqueous solution (pg. 3, lines 104-107).

In re claim 16, Hitachi discloses in figures 12-15 a semiconductor device manufacturing method comprising the steps of: (a) bringing a gas or an aqueous solution containing an etchant selected from the group consisting of NH3, N2H2, amines, amino compounds, and their derivatives into contact with a surface of a

substrate on which an insulating film is exposed to chemically activate the surface (pg. 3, lines 107-111), (b) reforming the chemically activated surface formed in step (a) by contacting the chemically activated surface with a gas or an aqueous solution containing an oxidizing agent selected from the group consisting of H2O2, O3, O2, HNO3, H2SO4, and their derivatives to form an oxide film (34) on the chemically activated surface (pg. 3, lines 107-111; pg. 7 lines 5-26), and (c) forming an insulating film (37) by CVD (pg. 7, lines 15-30; pg. 5, lines 75-90) on the oxide film (34) as formed in step (b) .

In re claim 17, Hitachi discloses wherein the surface brought into contact with the etchant has a silicon oxide (31) or silicon nitride film exposed on.

In re claim 18, Hitachi discloses wherein a semiconductor or metal layer is additionally exposed on the surface brought into contact with the etchant (pg. 7, lines 24-26, 52-56).

In re claim 23, Hitachi in figures 1, 12-16 discloses a semiconductor device manufacturing method comprising the steps of: a) preparing a mixed solution containing NH3 and H2O2 (pg. 3, lines 108-122; pg. 5, lines 74-87; pg. 7, lines 5-26); b) heating the mixed solution so that NO2- and NO3- are formed in the mixed solution in predetermined concentrations (pg. 3, lines 105-120); c) contacting a surface of a Silicon oxide film with the mixed solution after the heating (pg. 3, lines 107-111; pg. 7 lines 5-26; and d) forming an insulating film by CVD on the surface (pg. 7, lines 15-30; pg. 5, lines 75-90) as obtained in step © .

In re claim 25, Hitachi discloses a semiconductor device manufacturing method consisting of the steps of: a) brining a gas or an aqueous solution containing an etchant selected from the group consisting of: NH3, hydrazine, amines, aminos, and their derivatives into contact with a surface of a substrate on which an insulating film is exposed to chemically activate the surface (pg. 3, lines 108-122; pg. 5, lines 74-87; pg. 7, lines 5-26); b) reforming the chemically activated surface as formed in step a) by contacting the chemically activated surface with a gas or an aqueous solution containing an oxidizing agent selected from the group consisting of H2O2, O3, O2, HNO3, H2SO4, and their derivatives to form an oxide film on the chemically activated surface (pg. 3, lines 108-122; pg. 5, lines 24-27, 74-87; pg. 7, lines 5-26; pg. 9, lines 20-22; claim 10); c) forming an insulating film by CVD on the oxide film as formed in step b) (pg. 3, lines 110-120; pg. 5, lines 20-40; pg. 7, lines 9-30).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 12, 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hitachi in view of Ikakura et al. (EP 1-058-301). Hitachi discloses in figures 1, 12-16 a semiconductor device manufacturing method comprising the steps of: contacting a surface of Silicon oxide film with an aqueous solution containing any one of NO2 and NO3 and forming an insulating film by CVD on the surface after the film-forming surface

is contacted with the aqueous solution (pg. 3, lines 108-122; pg. 5, lines 74-87; pg. 7, lines 5-26). However, Hitachi does not teach using CVD that employs a reaction gas that contains O3 and TEOS. However, Ikakura et al. teaches that it is well known in the art to form SiO2 by CVD using O3 and TEOS (fig. 3c, abstract, ¶¶ 1-11). Therefore, it would have been obvious to one skilled din the art to modify the film forming surface of a substrate followed by the formation of an insulating layer as taught by Hitachi, using the conventional methods of CVD taught by Ikakura et al. because modifying the film forming surface reduces roughness and prepares the film surface for deposition. Modifying the film-forming surface with NH3 and H2O2 promotes adhesion of insulating layers in order to enable the oxide formation step of Ikakura et al. to be performed.

In re claim 24, Hitachi teaches wherein the insulating film is a Silicon-containing film that is formed by thermal CVD using TEOS (pg. 1, lines 65-70; pg. 5, lines 80-85). However, Hitachi does not teach using CVD that employs a reaction gas that contains O3. However, Ikakura et al. teaches that it is well known in the art to form SiO2 by CVD using O3 and TEOS (fig. 3c, abstract, ¶¶ 1-11). Therefore, it would have been obvious to one skilled din the art to modify the film forming surface of a substrate followed by the formation of an insulating layer as taught by Hitachi, using the conventional methods of CVD taught by Ikakura et al. because modifying the film forming surface reduces roughness and prepares the film surface for deposition. Modifying the film-forming surface with NH3 and H2O2 promotes adhesion of insulating layers in order to enable the oxide formation step of Ikakura et al. to be performed.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hitachi in view of Ghandi ("VLSI Fabrication Principles", 2nd edition, pp. 640-641). In re claim 19, Hitachi discloses wherein a semiconductor layer (30) or a metal layer (43, 44) is additionally exposed on the surface brought in contact with the etchant. However, Hitachi fails to teach that the etchant is an amine having a chemical formula of NR_nH_{3-1} (n=1, 2, 3; R: alkyl group). However Ghandi teaches rinsing the semiconductor layer several times using amines (pg. 641, lines 2-8). Therefore it would have been obvious at the time of the invention to modify the process of Hitachi to include an additional exposure of the semiconductor layer to an etchant that is an amine because amines can surface clean MOS based silicon circuits and cleaning of wafers must be done after each processing step in the fabrication sequence and especially before each high-temperature operation.

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Claims 20-22 are ~~20-2 is~~ rejected under 35 U.S.C. 103(a) as being unpatentable over Hitachi as applied to claim 19 above in view of Ghandi, and further in view of Ikakura et al. In re claim 16, Hitachi discloses in figures 12-15 a semiconductor device manufacturing method comprising the steps of: (a) bringing a gas or an aqueous solution containing an etchant selected from the group consisting of NH3, N2H2, amines, amino compounds, and their derivatives into contact with a surface of a substrate on which an insulating film is exposed to chemically activate the surface (pg. 3, lines 107-111), (b) reforming the chemically activated surface formed in step (a) by contacting the chemically activated surface with a gas or an aqueous solution containing an oxidizing agent selected from the group consisting of H2O2, O3, O2,

HNO3, H2SO4, and their derivatives to form an oxide film (34) on the chemically activated surface (pg. 3, lines 107-111; pg. 7 lines 5-26), and (c) forming an insulating film (37) by CVD (pg. 7, lines 15-30; pg. 5, lines 75-90) on the oxide film (34) as formed in step (b) . However, Hitachi does not teach or suggest wherein the insulating film is a silicon containing insulating film, which is formed by a thermal CVD employing O3 and TEOS. However, Ikakura et al. teaches that it is well known in the art to form SiO2 by CVD using O3 and TEOS (fig. 3c, abstract, ¶¶ 1-11). Therefore, it would have been obvious to one skilled din the art to modify the film forming surface of a substrate followed by the formation of an insulating layer as taught by Hitachi, using the conventional methods of CVD taught by Ikakura et al. because modifying the film forming surface reduces roughness and prepares the film surface for deposition. Modifying the film-forming surface with NH3 and H2O2 promotes adhesion of insulating layers in order to enable the oxide formation step of Ikakura et al. to be performed.

In re claim 21, Hitachi does not teach contacting a surface of a Silicon nitride film with H2O2 solution to reform the surface and then forming an insulating film on the reformed surface as obtained in step (a). Ikakura et al. teaches contacting a Silicon nitride film with H2O2 (¶20). It would be obvious to one skilled in the art to expose a Silicon nitride film to H2O2 for the advantages taught by Hitachi's cleaning step, which removes dangling bonds.

In re claim 22, Hitachi teaches wherein the insulating film is a Silicon containing film, which is formed by thermal CXVD by reacting O3 and TEOS (pg. 1, lines 63-72; pg. 5, lines 80-89). However, Hitachi does not teach using CVD that employs a reaction

gas that contains O3. However, Ikakura et al. teaches that it is well known in the art to form SiO2 by CVD using O3 and TEOS (fig. 3c, abstract, ¶¶ 1-11). Therefore, it would have been obvious to one skilled din the art to modify the film forming surface of a substrate followed by the formation of an insulating layer as taught by Hitachi, using the conventional methods of CVD taught by Ikakura et al. because modifying the film forming surface reduces roughness and prepares the film surface for deposition. Modifying the film-forming surface with NH3 and H2O2 promotes adhesion of insulating layers in order to enable the oxide formation step of Ikakura et al. to be performed.

Response to Arguments

Applicant's arguments with respect to claims 8-10, 12, 16-24 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's representative asserts that the examiner is reading applicants' term 'derivative [sic] in a vacuum'. Applicant's reasoning is wrong for seven reasons. First, the examiner is reading the term derivative in the claims in light of the specification. Second, as pointed out in action #11 the amount of derivatives for NH3, hydrazine, amines, amino compounds found in claims 16 and 25 is limitless. Third, the amount of derivatives for H2O2, O3, O2, HNO3, H2SO4 is limitless. Fourth, the applicant fails to provide a single species of the broad genus of an etchant that is an amide having a chemical formula NRnH3-n (n=1, 2, 3, R: alkyl group). Fifth, a chemical compound search of N-CH-H2 produces 25 compounds, 123 results for N(C6H8)2H, and 22 results N(C6H6)H2, (see attached www.chemifinder.com searches). Sixth, the applicant fails to provide any representative species for the amine derivatives in their instant

specification (pg. 15, lines 3-8). And lastly, the applicant fails to comply with 112, ¶1 because the derivatives of NH3, hydrazine, amines, amino compounds, H2O2, O3, O2, HNO3, H2SO4 because they are not defined in the specification and one of ordinary skill would not be able to apprise all of the combinations due to the unpredictability of chemical compounds.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. <Chemical compound search>, See attached www.chemfinder.com search results.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group Receptionist whose telephone number is (703) 308-0957. See MPEP 203.08.

Any inquiry concerning this communication from the examiner should be directed to Lisa Kilday whose telephone number is (703) 306-5728. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamand Cuneo, can be reached on (703) 308-1233. The fax number for the group is (703) 305-3432. MPEP 502.01 contains instructions regarding procedures used in submitting responses by facsimile transmission.

Lisa Kilday

LAK

6/2/03

VINH P. NGUYEN
PRIMARY EXAMINER
GROUP 2829
06/02/03